
प्रदीपक कार्यकारिता

भाग 2 कार्यकारिता अपेक्षाएँ

खण्ड 2 गली-प्रकाश के लिए एल ई डी प्रदीपक

Luminaires Performance

Part 2 Particular Requirements

Section 2 LED Street Lighting Luminaire

ICS 29.140.99

© BIS 2017



भारतीय मानक ब्यूरो

BUREAU OF INDIAN STANDARDS

मानक भवन, 9 बहादुरशाह ज़फर मार्ग, नई दिल्ली-110002

MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG

NEW DELHI-110002

www.bis.gov.in www.standardsbis.in

FOREWORD

This Indian Standard (Part 2/Section 2) was adopted by the Bureau of Indian Standards, after the draft finalized by the Lamps and Related Equipments Sectional Committee had been approved by the Electrotechnical Division Council.

This standard specifies the performance requirements for LED-street lighting luminaire. The other parts and sections in the series are:

Part 1 General requirements

Part 2 Particular requirements, Section 1 LED luminaire

Safety requirements have been covered in IS 10322 (Part 5/Section 3).

At present, luminaire with conventional light sources are being used for the street lighting luminaire. Keeping in view of the energy conservation, increased life and recurring savings on account of maintenance, energy efficient LED based street lighting luminaire are being extensively used for street light. In view of the increased use of LED luminaire for street lighting particularly by the utilities and urban local bodies, a need has been felt to have national standard in order to ensure the desired quality and energy efficiency of the luminaire.

This standard for LED luminaires for general lighting applications acknowledges the need for relevant tests for luminaires using this new source of electrical light, sometimes called “solid state lighting”. This standard is seen in close context with simultaneously developed publication of performance standards for luminaires in general and for LED modules. Therefore, any changes in the LED street lighting luminaires standard will have impact on the LED module standards and vice versa, due to the behaviour of LED. While preparing this standard, considerable assistance has been derived from the following standards:

IEC 62272-1 : 2014	Luminaire performance — General requirements
IEC 62272-2-1 : 2014	Luminaire performance — Particular requirements for LED luminaires
IEC 62717 : 2014	LED modules for general lighting — Performance requirements
IEC 62031 : 2014	LED modules for general lighting — Safety specifications

A provision for acceptance of test results of lumen maintenance at 2 000 h as interim criteria has been included in this standard. However, the test shall continue till 6 000 h.

The provisions in the standard represent the technical knowledge of experts from the fields of the semiconductor (LED chip) industry and of those of the traditional electrical light sources and luminaires.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated expressing the result of a test, shall be rounded off in accordance with IS 2 : 1960 ‘Rules for rounding off numerical values (*revised*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

LUMINAIRES PERFORMANCE

PART 2 PARTICULAR REQUIREMENTS

Section 2 LED Street Lighting Luminaire

1 SCOPE

1.1 This standard (Part 2/Section 2) specifies the performance requirements for LED street lighting luminaire, together with the test methods and conditions, required to show compliance with this standard suitable for use on dc supplies up to 250 V dc or on ac supplies up to 1 000 V at 50 Hz. It applies to LED luminaires for street lighting, where claims of operational performance are made.

The following types of LED street lighting luminaires are distinguished:

- a) *Type A* — Luminaire using LED modules where compliance with IS16103 (Part 2) has not been proven.
- b) *Type B* — Luminaire using LED modules where compliance with IS16103 (Part 2) has been proven.
- c) *Type C* — Luminaire using a LED lamp and covered in IS 16107 (Part 1)

NOTE — The definition of the LED module is given in IS 16103 (Part 1 and Part 2) and IS 16101.

This standard does not cover LED street light luminaires that intentionally produce coloured light; neither does it cover modules based on OLEDs (organic LEDs).

The performance requirements are additional to the requirements given in IS 16107 (Part 1).

The luminaire covered under the scope of this standard shall comply with the safety requirements given in IS 10322 (Part 5/Section 3).

Life time of LED luminaires is in most cases much longer than the practical test times. Consequently, verification of manufacturer's life time claims cannot be made in a sufficiently confident way. For that reason, the acceptance or rejection of a manufacturer's life time claim, past 25 percent of rated life (with a maximum of 6 000 h), is out of the scope of this standard.

Instead of life time validation, this standard has opted for lumen maintenance categories at a defined finite

test time. Therefore, the category number does not imply a prediction of achievable life time. The categories are lumen-depreciation character categories showing behaviour in agreement with manufacturer's information which is provided before the test is started.

In order to validate a life time claim, an extrapolation of test data is needed. A general method of projecting measurement data beyond limited test time is under consideration.

For explanation of life time metrics *see* Annex C of IS16103 (Part 2).

The acceptance or rejection criterion of the life time test as defined in this standard is different from the life time metrics claimed by manufacturers.

1.2 It is expected that LED-street light luminaire which comply with this standard will be able to start and operate at voltages between 90 percent and 110 percent of rated supply voltage and at an ambient air temperature within the declared range of the manufacturer.

2 REFERENCES

2.1 The following Indian Standards are necessary adjuncts to this standard:

<i>IS No.</i>	<i>Title</i>
1885 (Part 16/Sec 1) : 1968	Electrotechnical vocabulary: Part 16 Lighting, Section 1 General aspects
(Part 16/Sec 2) : 1968	Lighting, Section 2 General illumination, lighting fittings and lighting for traffic and signalling
(Part 16/Sec 3) : 1967	Lighting, Section 3 Lamps and auxiliary apparatus
10322 (Part 1) : 2014	Luminaires: General requirements and tests
(Part 5/Sec 3) : 2012	Particular requirements, Section 3 Luminaire for road and street lighting

IS 16107 (Part 2/Sec 2) : 2017

<i>IS No.</i>	<i>Title</i>
14700 (Part 3/Sec 2) : 2008	Electromagnetic compatibility (EMC): Part 3 Limits, Section 2 Limits for harmonic current emissions (equipment input current less than or equal to 16 A per phase)
16101 : 2012	General Lighting — LEDs and LED modules — Terms and definitions
16103 (Part 1) : 2012	LED modules for general lighting: Safety requirements
(Part 2) : 2012	Performance requirements
16104 : 2012	d.c. or a.c. supplied electronic control gear for LED modules — Performance requirements
16105 : 2012	Method of measurement of lumen maintenance of solid state light (LED) sources
16106 : 2012	Method of electrical and photometric measurements of solid-state lighting (LED) products
16107 (Part 2/Sec 1) : 2012	Luminaire performance: Part 2 Particular requirements, Section 1 LED luminaire
IS/IEC 60529 : 2001	Degree of protection provide by enclosure (IP code)
SP 72 : 2010	National Lighting Code

3 TERMINOLOGY

For the purposes of this standard, the following definitions in addition to those given in IS 16101, 16103 (Part 2), 16107 (Part 1), 16107 (Part 2/Section 1), IS 1885 (Part 16/Section 1), IS 1885 (Part 16/Section 2) and IS 1885 (Part 16/Section 3) shall apply.

3.1 LED Street Lighting Luminaire

Luminaire incorporating LED as light sources.

3.2 Family of LED Street Lighting

Group of LED streetlight luminaires that have (*see also Annex B*)

- LED modules with the same method of control and operation for example self-ballasted, semi-ballasted and non-ballasted;
- LED modules with the same classification according to the method of installation [*see 6 of IS 16103 (Part 1)*];
- same class of protection against electrical shock; and

- same design characteristics, distinguished by common features of materials, components, and/or method of processing.

3.3 Rated Ambient Performance Temperature (t_q)

Highest ambient temperature around the luminaire related to a rated performance of the luminaire under normal operating conditions, both as declared by the manufacturer or responsible vendor.

NOTES

1 $t_q \leq t_a$. For t_a , *see* **1.2.25** of IS 10322 (Part 1). Temperatures are marked in °C.

2 For a given life time, the t_q temperature is a fixed value and not a variable.

3 There can be more than one t_q temperature, depending on the life time claim.

3.4 Rated Median Useful Life (of LED Luminaire)

Length of time during which 50 percent (B_{50}) of a population of operating LED Luminaires of the same type have parametrically failed, under standard test conditions as declared by the manufacturer or responsible vendor.

3.5 LED Luminaire Luminous Efficacy

Ratio of the luminaire total luminous flux to its input power at rated supply voltage, excluding any emergency lighting charging power.

NOTE — Luminaire efficacy is expressed in lumens per watt.

3.6 Type Test

Test or series of tests made on a type test sample for the purpose of checking compliance of the design of a given product with the requirements of the relevant standard.

3.7 Type Test Sample

Sample consisting of one or more similar units submitted by the manufacturer or responsible vendor for the purpose of the type test.

3.8 Acceptance Test

Tests carried out on samples taken from a lot for the acceptance of the lot.

4 MARKING

4.1 Product Information

Information on the parameters shown in Table 1 shall be provided by the manufacturer or responsible vendor on the product datasheets, leaflets or website.

Compliance is checked by inspection.

NOTE — This information is in addition to the marking given in IS 10322 (Part 1).

4.2 BIS Certification Marking

4.2.1 The LED street lighting luminaire may also be marked with the Standard Mark.

4.2.2 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The details of the conditions under which the license for the use of the Standard Mark may be granted to the manufacturers or producers may be obtained from the Bureau of Indian Standards.

5 SAFETY REQUIREMENTS

The LED street lighting luminaire shall meet all the safety requirements specified in IS 10322 (Part 5/Section 3) before the luminaires are subjected to the performance requirements.

6 TEST CONDITIONS

6.1 General Conditions of Test

Street lighting luminaire shall be tested complete with the light source and controlgear specified by the manufacturer. Except where otherwise specified, the

luminaire, light source and controlgear shall be tested as new, and installed as for normal use, having regard to the manufacturer's installation instructions.

Test conditions for testing electrical and photometric characteristics, lumen maintenance and life are given in IS 16103 (Part 2).

All tests are measured on 'n' LED street lighting luminaires of the same type. The number 'n' shall be a minimum of products as given in Table 3. LED Street lighting luminaires used in the endurance tests shall not be used for other tests (*see* Table 3).

In addition to the requirement given in this standard, the street lighting luminaire shall also meet all requirements of Part 1 of this standard. Where it is specified by this standard that data is to be provided, this data may be supplied by the manufacturer in printed or electronic formats, via the manufacturer's catalogues or similar, unless otherwise specified by this standard.

Street lighting luminaire shall be photometrically rated, electrically rated and efficacy-rated with any wattage not exceeding the marked maximum, and any technology LED module or self-ballasted LED lamps provided if these lamps satisfy the requirements of relevant safety standard and are shown to comply with that standard.

Table 1 Mandatory Marking and Location of Marking

(Clauses 4.1 and 9.3)

Sl No.	Parameters	Product	Packaging	Product Datasheets, Leaflets or Website
(1)	(2)	(3)	(4)	(5)
i)	Rated input power (W)	x	x	—
ii)	Photometric code ¹⁾	—	x	x
iii)	Rated luminous flux (lm)	x	x	x
iv)	Rated median useful life (h) and the associated rated lumen maintenance factor (x)	—	x	x
v)	Rated abrupt failure fraction (%)	—	x	x
vi)	Lumen maintenance code ²⁾	—	x	x
vii)	Rated chromaticity coordinates both initial and maintained ³⁾	—	—	x
viii)	Correlated colour temperature in K (CCT)	x	x	x
ix)	Rated colour rendering index (CRI)	x	x	x
x)	Operating temperature range of luminaire	—	—	x
xi)	Luminaire efficacy (lm/W)	—	—	x
xii)	Rated ambient temperature (t_a) related to performance for a luminaire ⁴⁾	—	—	x
xiii)	Date of manufacture, batch number/serial No.	x	x	—
xiv)	Luminous intensity distribution	—	—	x

where

'x' = required, '—' = not required.

¹⁾ *see* Annex D of IS 16103 (Part 2).

²⁾ *see* Table 6 of IS 16103 (Part 2).

³⁾ *see* Table 5 of IS 16103 (Part 2).

⁴⁾ *see* 3.3 of IS 16107 (Part 2/Section 1).

Table 2 Performance Criteria of which Testing is Required*(Clauses 6.1, 6.4, 17 and 18.1.1)*

Sl No.	Clause or Sub-clause of This Standard [in Brackets Clause or Sub-clause of IS 16103 (Part 2)]	Testing	LED Streetlight Luminaire Type B^{1),2)}	LED Streetlight Luminaire Type A
(1)	(2)	(3)	(4)	(5)
i)	6.3.1	LED module performance temperature	x	x
ii)	7	Total input power	x	x
iii)	8.1	Luminous flux	x	x
iv)	8.3.3	Luminous intensity distribution ³⁾	x	x
v)	8.2	Luminous efficacy	x	x
vi)	9.1	Initial chromaticity tolerance of the light source ⁴⁾	—	x
vii)	9.1	Maintained chromaticity tolerance of the light source ⁴⁾	—	x
viii)	9.2	Initial correlated colour temperature of the light source ⁴⁾	—	x
ix)	9.3	CRI initial ⁴⁾	—	x
x)	9.3	CRI maintained ⁴⁾	—	x
xi)	10.3	Lumen maintenance	—	x
xii)	10.4 (10.3.2)	Temperature cycle, energized	—	x
xiii)	10.4 (10.3.3)	Supply switching voltage	—	x
xiv)	10.4 (10.3.4)	Accelerated operation life	—	x
xv)	12	Power factor	x	x
xvi)	13	Harmonics	x	x
xvii)	14	Surge protection	x	x
xviii)	15	Reverse Polarity	x	x
xix)	16	Ingress protection	x	x

NOTE — (x= required, — = not required).

¹⁾ Where the LED manufacturers provide data according to IS 16103 (Part 2), the tests on the luminaire may be carried out according to the column for Type B luminaires.²⁾ Testing requirements for Type B LED luminaires will depend on the requirements of IS 16103 (Part 2). It is not the intention to re-measure the values of a product complying with its own standard. However where luminaires combine different LED modules in one luminaire, or where secondary optics are added in the luminaire, certain parameters may be required to be measured, for example if there is a mixing of colours, the final CRI and CCT need to be measured in the luminaire.³⁾ Applicable to luminaires which modify the light distribution of the light from the LED module.⁴⁾ The values of **9.1**, **9.2** and **9.3** relate to the light source.

Each sample of luminaire shall comply with all the relevant tests (as applicable in Table 2) as per sample size mentioned in Table 3. In order to reduce the time of testing the manufacturer or responsible vendor may submit additional luminaires or parts of luminaires provided that these are of the same materials and design as the original luminaire and that the results of the test are the same as if carried out on an identical luminaire.

LED street lighting luminaires with dimming control shall be adjusted to maximum output for all tests.

6.2 Street lighting luminaires with LED modules where compliance with IS 16103 (Part 2) has not been proven (Type A luminaire)

6.2.1 *Testing where Reliability Data of Components Available*

Test duration shall be 10 percent of rated life time up

to a maximum of 2 000 h making use of components where long-term test data are available.

Compliance criteria for allowance of 2 000 h test duration shall be as follows:

Component test data for the principle components shall cover at least 25 percent of rated LED module lifetime up to a maximum of 6 000 h. The principle components, where applicable, shall be LED packages, electronics, diffusers (including remote phosphors), lenses, reflectors, internal wirings and active cooling systems. Apart from the full set of data provided upon the 2 000 h, the manufacturer or responsible vendor shall also provide the expected data for at least 25 percent of rated LED module lifetime up to a maximum of 6 000 h of,

- Chromaticity co-ordinates; and
- Lumen maintenance code.

Table 3 Sample Sizes
(Clauses 6.1, 6.4, 17 and 18.1.1)

S1 No.	Clause or Sub-clause of this Standard [in Brackets Clause or Sub-clause of IS 16103 (Part 2)]	Test	No Reliability Data of Components Available Minimum Sample Size (Units) for Testing at 25% of Life Time (6 000 h) <i>Max</i>	LED Modules where Compliance with IS 16103 (Part 2) has been proven Minimum Sample Size (Units) for Testing (0 h)
(1)	(2)	(3)	(4)	(5)
i)	6.3.1	LED module performance temperature	Same 5 samples for all tests	1
ii)	7	Total input power		1
iii)	8.1	Luminous flux		1
iv)	8.3.3	Luminous intensity distribution		1
v)	8.2	Luminous efficacy		1
vi)	9.1	Initial chromaticity tolerance of the light source		—
vii)	9.1	Maintained chromaticity tolerance of the light source		—
viii)	9.2	Initial correlated colour temperature of the light source		—
ix)	9.3	CRI Initial		—
x)	9.3	CRI maintained		—
xi)	10.3	Lumen maintenance		—
xii)	12	Power factor		1
xiii)	13	Harmonics		1
xiv)	10.4 (10.3.2)	Temperature cycle, energised	3	—
xv)	10.4 (10.3.3)	Supply switching voltage	3	—
xvi)	10.4 (10.3.4)	Accelerated operation life	3	—
xvii)	14	Surge protection	3	1
xviii)	15	Reverse Polarity	3	1
xix)	16	Ingress protection	3	1

6.2.2 Testing where no Reliability Data of Components Available

If component long-term test data is not available, the manufacturer shall conduct testing for 25 percent of rated life up to a maximum of 6 000 h.

6.2.3 Creation of Module Families to Reduce Test Effort

6.2.3.1 General

The provisions of 6.2.1 of IS 16103 (Part 2) shall apply to the LED street lighting luminaire.

6.2.3.2 Variations within family

The provisions of 6.2.2 of IS 16103 (Part 2) shall apply to the LED street lighting luminaire.

6.2.3.3 Compliance testing of family members

The provisions of 6.2.3 of IS 16103 (Part 2) shall apply to the LED street lighting luminaire.

6.3 Street lighting luminaires with LED modules where compliance with IS 16103 (Part 2) has been proven ('Type B' Luminaire)

6.3.1 General

Tests are only carried out for initial performance test. The manufacturer shall conduct testing for 25 percent of rated life up to a maximum of 6 000 h.

Only the tests for measurement of initial performance are to be conducted, when the LED Module is operated within its temperature limit t_p .

The information for the luminaire design given in B-1 of IS 16103 (Part 2), requires LED modules to be operated within their t_p temperature limit. The t_p temperature shall be measured according to the thermal test procedure defined in 12.4 of IS 10322 (Part 1) (normal operation). When the luminaire is operating at its own maximum rated ambient temperature for performance (t_a), the t_p limit [for the declared performance — Table 2 of IS 16103 (Part 2)] of LED modules operating inside the luminaire shall not be exceeded. The test voltage for the luminaire shall be 1.00 times the rated voltage of the luminaire. If luminaires intended to be supplied with constant current, the test current shall be 1.00 times the rated current of the luminaire.

IS 16107 (Part 2/Sec 2) : 2017

For luminaires for street lighting intended for outdoor use only, the reduction of the measured temperature according to 13.1 of IS 10322 (Part 5/Section 3) shall not be applied for t_p temperature of LED module.

The ambient performance temperature t_q is measured in a draught-proof enclosure, as the air temperature, at a position near one of the perforated walls on a level with the centre of the luminaire as given in Annex K of IS 10322 (Part 1).

6.3.2 Creation of Module Families to Reduce Test Effort

6.3.2.1 General

The provisions of 6.2.1 of IS 16103 (Part 2) and Annex B shall apply to the LED street lighting luminaire.

6.3.2.2 Variations within family

The provisions of 6.2.2 of IS 16103 (Part 2) and Annex B shall apply to the LED street lighting luminaire.

6.3.2.3 Compliance testing of family members

The provisions of 6.2.3 of IS 16103 (Part 2) and Annex B shall apply to the LED street lighting luminaire.

6.4 Performance Requirements

The LED street lighting luminaire shall be subjected to all the tests specified in Table 2. The performance criteria given in Table 2 and the required testing for each type of LED street lighting luminaire is indicated by the letter 'x'. All other data is available from the respective product standard.

The performance criteria given in Table 2 applies for LED street lighting luminaires of the types given in the scope of this standard. All of the tested n LED luminaires as specified in Table 3 shall comply with all the requirements given in this standard.

7 TOTAL INPUT POWER

7.1 Power shall be measured at the supply to the luminaire or in case of remote control gear, at the supply to the control gear. The provisions of 7 of IS 16103 (Part 2) shall apply.

NOTE — For calculation of confidence intervals, see Annex E of IS 16103 (Part 2).

8 PHOTOMETRIC REQUIREMENTS

8.1 Luminous Flux

The provisions of 8.1 of IS 16103 (Part 2) shall apply to the LED luminaire. In addition, the provisions of Annex A, shall apply where a declared ambient air

temperature other than 25 °C is declared by the manufacturer.

8.2 Minimum Luminaire Efficacy (lm/W)

The method of tests shall be as specified in IS 16103 (Part 2). The luminaire efficacy shall not be less than 80 lm/W.

NOTE— The lumen (lm) values for efficacy calculation shall be initial lumen measurements.

8.3 Luminous Intensity Distribution

8.3.1 General

The provisions of 8.2.1 of IS 16103 (Part 2) apply to the LED streetlight luminaire.

8.3.2 Measurement

The provisions of 8.2.2 of IEC 62717 apply to the LED luminaire.

8.3.3 Luminous Intensity Distribution

The provisions of 8.2.3 of IS 16103 (Part 2) shall apply to the LED streetlight luminaire.

8.4 Photometric Test

8.4.1 The photometric performance shall be determined by the test method given in IS 16106. The photometric requirements shall be as given in 17.1 to 17.4 of IS 10322 (Part 5/Section 3).

9 CHROMATICITY CO-ORDINATES, CORRELATED COLOUR TEMPERATURE AND COLOUR RENDERING

9.1 Chromaticity Co-ordinates

The provisions of 9.1 of IS 16103 (Part 2) shall apply to the LED streetlight luminaire.

9.2 Correlated Colour Temperature (CCT)

The provisions of 9.2 of IS 16103 (Part 2) shall apply to the LED streetlight luminaire.

The test shall be carried out as per the method given in IS 16106. The nominal and target value shall be as specified in Table 4.

Table 4 Correlated Colour Temperature
(Clause 9.2)

Sl No.	Nominal CCT	Target CCT ± Tolerance
(1)	(2)	(3)
i)	2 700	2 725 ± 145
ii)	3 000	3 045 ± 175
iii)	3 500	3 465 ± 245
iv)	4 000	3 985 ± 275
v)	5 000	5 028 ± 283
vi)	5 700	5 665 ± 355
vii)	6 500	6 530 ± 510

9.3 Colour Rendering Index (CRI)

The provisions of 9.3 of IS 16103 (Part 2) shall apply to the LED Streetlight luminaire.

For all tested items in the sample, the measured CRI value shall not have decreased by more than:

- a) 3 points from the rated CRI value (*see* Table 1) for initial CRI values; and
- b) 4 points from the rated CRI value, when tested for 6 000 h for maintained CRI values.

The colour rendering index shall be at least 70.

10 LED LUMINAIRE LIFE

10.1 General

The provisions of 10.1 of IS 16103 (Part 2) shall apply to the LED streetlight luminaire.

10.2 Minimum Rated Luminaire Lifetime (B_{50})

The test shall be carried out as per the method given in IS 16103 (Part 2). At 25 000 h 50 percent of population shall be operative at maximum specified ambient temperature and within defined tolerance limit of input power condition.

10.3 Lumen Maintenance

LED luminaires using modules shown to be in conformity with 6.2 of IS 16103 (Part 2) do not have to be submitted for the test. Maintenance values declared for the module at the considered rated t_p , $t_{p\max}$ may be declared as the maintenance values of the luminaire for the related rated t_q .

Other luminaires are submitted for the test. The provisions of 10.2 of IS 16103 (Part 2) apply to the LED luminaire except that the maintenance test shall be conducted at the ambient temperature in the temperature interval (rated t_q , rated $t_q - 2^\circ\text{C}$). The provisions of 10.2 of IS 16103 (Part 2) apply to the LED luminaire, except that the maximum rated temperature t_p of the LED module is not exceeded in the luminaire during testing as long as the interval (rated $t_p - 5$, rated t_p) is maintained.

The measured luminous flux value shall not be less than the luminous flux value given by the rated lumen maintenance factor related to rated median useful life.

For all the tested items in a sample, the measured values shall be of the same maintenance code as the provided values. All the LED modules in a sample shall pass the test.

The lumen maintenance at 25 000 h shall be greater than 70 percent of the initial luminous flux.

NOTE — At 2 000 h, the lumen depreciation shall not be more than 30 percent of the claimed lumen depreciation over life. The test results at 2 000 h may be considered as interim acceptance criteria. However, the test shall be continued till 6 000 h.

10.4 Endurance Tests

The provisions of 10.3 of IS 16103 (Part 2) shall apply to the LED streetlight luminaire.

Endurance test shall be performed only on a LED luminaire using a LED module not tested for compliance with IS 16103 (Part 2).

For accelerated operation life test, a LED luminaire using a LED module where compliance with IS 16103 (Part 2) has not been proven, shall be operated at a temperature corresponding to 10 K above maximum t_q advised by the manufacturer or responsible vendor. Separate samples shall be used for the endurance tests in 10.3.2, 10.3.3 and 10.3.4 of IS 16103 (Part 2).

11 OPERATING TEMPERATURE (RANGE °C)

There shall not be any significant change in the performance requirements of photometric and colourmetric performance within the temperature range from 0°C to 45°C .

12 POWER FACTOR

The test shall be carried out in accordance with IS 14700 (Part 3/Section 2). Power factor of the LED street lighting luminaire shall be not less than 0.9.

13 HARMONICS

The harmonics of the input current when measured in accordance with IS 14700 (Part 3/Section 2) shall be as given in Table 5 of IS 16102 (Part 2). The total harmonic distortion (THD) shall not be more than 20 percent.

14 SURGE PROTECTION

The luminaire shall withstand a surge of $4\text{ kV} \pm 3$ percent for $50\text{ }\mu\text{s} \pm 20$ percent at the input terminals for all types. The test shall be carried out as per the method given in 5.4 of IEC 60571-1.

15 REVERSE POLARITY (FOR d.c. SUPPLIES ONLY)

15.1 The luminaire shall withstand tests for polarity reversal. It shall be operated with reverse voltage for 5 min at maximum value of voltage range. At the end of this period, the supply shall be made correct polarity and luminaire shall operate in a normal way.

16 INGRESS PROTECTION (IP)

16.1 The test for IP shall be carried out as specified in IS 10322 (Part 1) and IS/IEC 60529. The ingress protection shall be IP 65 or greater.

17 VERIFICATION

The minimum sampling size for type testing shall be as given in Table 3. The sample shall be representative of a manufacturer's production. If the LED luminaire does not change the properties of single LEDs, LED packages or LED modules, it should be allowed to reference to test data of the LED manufacturers.

The results of the test shall comply with the requirements given in Table 2.

NOTE — Requirements for whole production testing are under consideration.

For a luminaire with external control gear, the input power of the external control gear required to operate the luminaire should be taken into account. For measurement *see* IEC 62442-3, Figure 1, and including any controls inputs.

This is for the for the purpose of the efficacy calculation of the luminaire inclusive of the external control gear.

18 SCHEDULE OF TESTS

18.1 Type Tests

18.1.1 Type tests shall be carried out to prove confirmation with the requirement of specification and general quality and design features of the unit. In case of any change in the construction and design, complete type test shall be repeated.

Before commencement of the tests, the LED street lighting luminaire shall be visually examined and inspected of components, parts and their assembly, constructions, mechanical hazards, marking provision of suitable terminals for supply connections, earthing and the effectiveness screws and connection. The external surface finish shall be even and free from finishing defects.

The minimum sampling size for type testing shall be as given in Table 3. The sample shall be representative of a manufacturer's production. If the LED street lighting luminaire does not change the properties of single LEDs or LED packages or LED modules it should be allowed to reference to test data of the LED manufacturer. The results of the test shall comply with the requirements given in Table 2. If the test results do not comply with these requirements, the manufacturer's test records shall be requested.

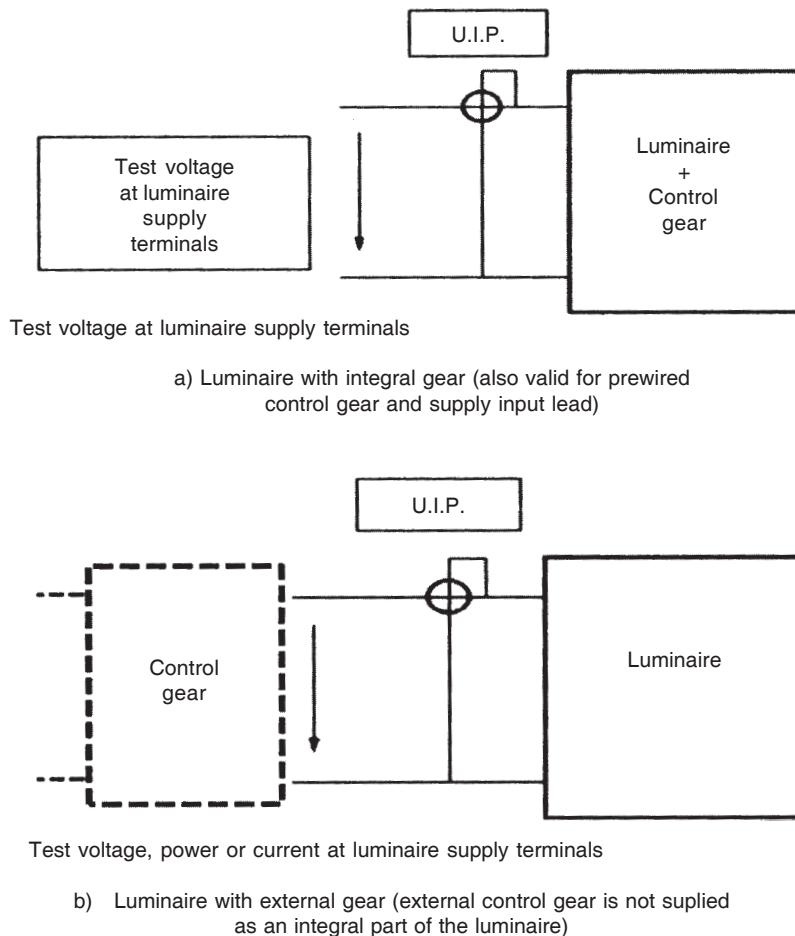


FIG. 1 TERMINALS TO BE USED FOR INPUT POWER MEASUREMENT

Following shall constitute the type tests.

- a) Marking (*see 4*),
- b) Total input power (*see 7*),
- c) Luminaire efficacy (lm/W) (*see 8.2*),
- d) Lumen maintenance with failure fractions (*see 10.3*),
- e) Colour rendering index (CRI) (*see 9.3*),
- f) Correlated colour temperature (K) (*see 9.2*),
- g) Chromaticity coordinates (*see 9.1*),
- h) Power factor (*see 12*),
- j) Ingress protection (IP) (*see 16*),
- k) Endurance test (*see 10.4*),
- m) Surge protection (*see 14*),
- n) Minimum rated luminaire lifetime (B_{50}) (*see 10.2*),
- p) Reverse polarity (*see 15*),
- q) Harmonics (*see 13*),
- r) Luminous flux (*see 8.1*),
- s) Luminous intensity distribution (*see 8.3.3*), and
- t) LED module performance temperature (*see 6.2*).

18.1.1.1 Criteria of acceptance

Samples shall successfully pass all the type tests for proving conformity with the requirements of the standard. If the sample fails in any of the type tests, the testing authority at its discretion, may call for

fresh samples not exceeding twice the original number and subject them again to all tests or to the test(s) in which failure(s) had occurred. No failure should be permitted in the repeat test(s).

18.2 Acceptance Tests

These tests are carried out by an inspecting authority or the buyer at the supplier's premises on sample taken from a lot for the purpose of acceptance of a lot. Acceptance tests shall not be carried out from particular size from the lot on which type tests have already been conducted.

The luminaries shall be selected from the lot at random. In order to ensure randomness of selection, procedures given in IS 4905 may be followed. The method of sampling and the criteria for acceptance shall be as given in IS 2500 (Part 1). Following shall constitute the acceptance tests.

- a) Marking (*see 4*),
- b) Total input power (*see 7*),
- c) Luminaire efficacy (lm/W) (*see 8.3*),
- d) Colour rendering index (CRI) (*see 9.3*),
- e) Correlated colour temperature (K) (*see 9.2*),
- f) Chromaticity tolerance (*see 9.1*),
- g) Power factor (*see 12*),
- h) Luminous flux (*see 8.1*), and
- j) Luminous intensity distribution (*see 8.3.3*).

ANNEX A (Clause 8.1)

METHOD OF MEASURING LED STREETLIGHT LUMINAIRE CHARACTERISTICS

A-1 GENERAL

The provisions of **A-1** of IS 16103 (Part 2) shall apply to the LED streetlight luminaire, except that the wording in the second paragraph, first sentence “in the temperature interval $(t_{p\max} - 5, t_{p\max})$ ” does not apply to LED streetlight luminaires.

Where a rated ambient performance temperature t_q other than 25°C is advised by the manufacturer, a correction factor will need to be established to correct the measured luminous flux value at 25°C to the luminous flux value at the declared ambient temperature. This shall be done using relative photometry in a temperature controlled cabinet.

NOTE — If such a test setup is not feasible, a generic correction factor for temperature correction can be recommended for use of lighting application engineers. The methodology to arrive at such a correction factor need to be considered in future amendments to this standard.

A-2 ELECTRICAL CHARACTERISTICS

The provisions of **A-2** of IS 16103 (Part 2) shall apply to the LED streetlight luminaire.

A-3 PHOTO METRIC CHARACTERISTICS

The provisions of **A-3** of IS 16103 (Part 2) shall apply to the LED streetlight luminaire.

ANNEX B

PRODUCT FAMILY TESTING

(Clauses 3.2, 6.3.2.1, 6.3.2.2 and 6.3.2.3)

B-1 It is recognized that due to the time and cost required for product testing, it would not be realistic to expect manufacturers offering a multitude of unique luminaire configurations to test every possible configuration. Therefore, the “product families” method may be utilized, whereby manufacturers identify a set of representative products for which test data can be used to demonstrate the accuracy of interpolated or extrapolated performance of product configurations lacking test data. Precedent for this approach can be found in IS 16105.

If the particular luminaire configuration submitted has not been tested, the performance may be conservatively represented by test data for another luminaire configuration having:

- a) same intensity distribution (typically only applies to IS 16106),
- b) same or lower nominal CCT,
- c) same or higher nominal LED current,
- d) same or greater number of LED light source(s),
- e) same or higher system wattage and lower efficacy,
- f) same or smaller size luminaire housing, and
- g) same Architecture with same material of construction.

A more accurate estimate of performance can be obtained by linear interpolation between two or more tests differing in terms of the six parameters listed above.

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 1986 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Director (Publications), BIS.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

This Indian Standard has been developed from Doc No.: ETD 23 (10442).

Amendments Issued Since Publication

Amendment No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002

Telephones: 2323 0131, 2323 3375, 2323 9402

Website: www.bis.gov.in

Regional Offices:

Telephones

Central	: Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110002	{ 2323 7617 2323 3841
Eastern	: 1/14, C.I.T. Scheme VII M, V.I.P. Road, Kankurgachi KOLKATA 700054	{ 2337 8499, 2337 8561 2337 8626, 2337 9120
Northern	: Plot No. 4-A, Sector 27-B, Madhya Marg, CHANDIGARH 160019	{ 26 50206 265 0290
Southern	: C.I.T. Campus, IV Cross Road, CHENNAI 600113	{ 2254 1216, 2254 1442 2254 2519, 2254 2315
Western	: Manakalaya, E9 MIDC, Marol, Andheri (East) MUMBAI 400093	{ 2832 9295, 2832 7858 2832 7891, 2832 7892

Branches : AHMEDABAD. BENGALURU. BHOPAL. BHUBANESWAR. COIMBATORE.
DEHRADUN. DURGAPUR. FARIDABAD. GHAZIABAD. GUWAHATI.
HYDERABAD. JAIPUR. JAMMU. JAMSHEDPUR. KOCHI. LUCKNOW. NAGPUR.
PARWANOO. PATNA. PUNE. RAIPUR. RAJKOT. VISAKHAPATNAM.